The Editor of Handy Man's Workshop will be glad to receive any hints for this department and pay for them if available.

ANNOUNCEMENT.

The editor of Handy Man's Workshop has been flooded with inquiries about the home-made vacuum cleaner described in the issue of November 7. Many have expressed doubts as to the practicability of such a system, but we desire to assure our readers that the cleaner described is highly efficient. One of them has been installed near this city, and has been in constant use for some time, giving perfect satisfaction.

Owing to the widespread interest in this subject, we have asked the author to give us a second article answering the many questions of our readers. This article will appear in the next issue of Handy Man's Workshop.

LET THE CLOCK OPEN THE FURNACE DRAFTS.

BY H. L. WHITEMORE.

Most furnaces are nowadays arranged so that the drafts can be operated from the living rooms above, but still require the personal attention of some shivering member of the household, before dawn on cold winter mornings, if the house is to be comfortably warm by breakfast time. Undoubtedly much irritability and fatigue, if not actual sickness, can be traced to the strain of this early rising under the most unfavorable conditions.

It is a very simple matter, which anyone could undertake successfully, to so arrange an alarm clock that it will control all the drafts and dampers and open them at any desired time in the morning. If it is absolutely necessary to shake down the fire, remove ashes, and add fresh fuel, the problem is a much more difficult one, far beyond the strength or capacity of the dutiful alarm clock. Most furnaces, however, can, with a little experience, be so left the night before that on opening the drafts in the morning they will burn up rapidly and soon have the house at a comfortable temperature. Fresh fuel, unless absolutely necessary, actually delays the heating up of the house and is much better added later, when the demand for heat is not so urgent.

The apparatus comprises a base-board fitted with two screw eyes, through which the usual chains are passed. Hinged to the board with a pair of staples is a U-shaped lever, with one arm about 5 inches long and the other just long enough to catch the chains. The lever is located far enough above the screw eyes to allow for the proper opening and closing of the drafts. The screw eyes are not placed directly under the short arm of the lever, but on either side, so as to prevent the chains from kinking and catching on the hooks when they are released by the lever.

The alarm clock, which furnishes the brains for this apparatus, may be supported on a long hook or nail, and others bearing against the feet on each side will prevent it from swinging sidewise. Some people, who desire unbroken dreams, will turn the gong or bell upside down to put it out of the reach of the fiendishly energetic clapper, but that is an unimportant detail which may be left to personal taste and preference.

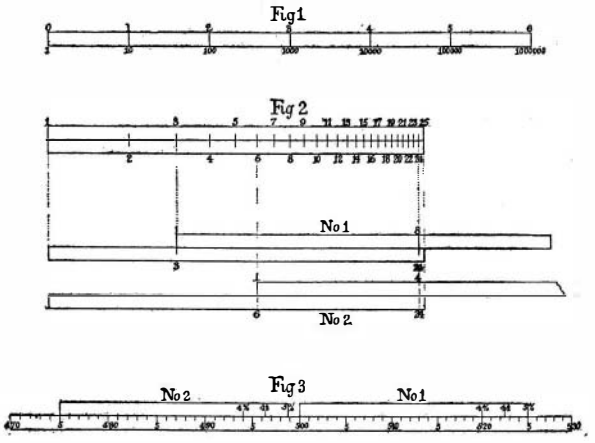
The clock, intended for a hard physical job like this, must have the alarm winding key so arranged that it unwinds when the alarm "goes off." There are a number of clocks on the market of different shapes and sizes which are made with this important feature.

To prevent chafing of the cord, unscrew this winding key and slip on, back of it, a thick cardboard washer. Then connect the key and wire lever with a piece of cord and the contrivance is ready for operation. After setting the clock, the cord should be wound onto the key in winding the alarm. Then the chains are hung in place on the lever. When the alarm "goes off" the lever turns on its pivot, releasing the chains and permitting the usual weight to drop and thereby open the drafts and damper. If the furnace is not arranged with a weight for operating the draft the chains may be connected directly to the key by a cord which will be wound up on the key as the alarm goes off.

HOW TO USE THE SLIDE RULE.

BY FREDERIC R. HONEY, TRINITY COLLEGE.

In comparatively recent times, the slide rule—whose value as an aid to rapid computations had been fully appreciated by the actuary, the engineer, and the architect—had not made its way into general use, owing partly to the cost of manufacture. At the present time, the instrument is constructed in a way so adapted to the needs of the business man, and at a cost which brings it within the reach of everyone, that it has become an indispensable possession of many who are engaged in commercial affairs.



SOME PRACTICAL USES OF THE SLIDE RULE.

A clear understanding of the fundamental principle of this valuable invention will make plain some of the many ways in which it may be practically applied. The illustrations here given are very much simplified, in order that a knowledge of the principle may be easily grasped. The parts composing the slide rule may be described as graphic representations of logarithms; i. e., the lengths of the measurements on the scale are proportional to the logarithms of the numbers which they represent.

Thus the scale, Fig. 1, which may be made of any convenient length, and may be assumed to represent the number one million, is divided into six equal parts from 0 to 1; from 1 to 2, etc. The number is indicated on the lower edge of the scale, and its logarithm on the upper edge: The logarithm of $1 = 0$, of $10 = 1$, of $100 = 2$, etc. This scale may be extended indefinitely, and if the logarithms of the intermediate numbers are marked upon it, the process of multiplication may be performed by addition; that of division by subtraction; a number may be raised to any power by multiplication; and any root may be extracted by division. Thus if it is required to multiply 100 by 1,000, add 2 to 3 (the logarithms of these numbers) $= 5$; and the product 100,000 is found under 5 (its logarithm). Two divisions on the scale are *added* to three divisions. If it is required to divide 10,000 by 1,000, three divisions on the scale are *subtracted* from four divisions, and the quotient is represented by one division or 10. The fourth power of 10 is found opposite 4; i. e., the number opposite 10 or 1 is *multiplied* by 4, which is the logarithm of 10,000. The cube root of 1,000,000 is found opposite 2; i. e., 6 (the logarithm of 1,000,000) is *divided* by 3; and the required root is 100. In the slide rule all of these operations are performed mechanically.

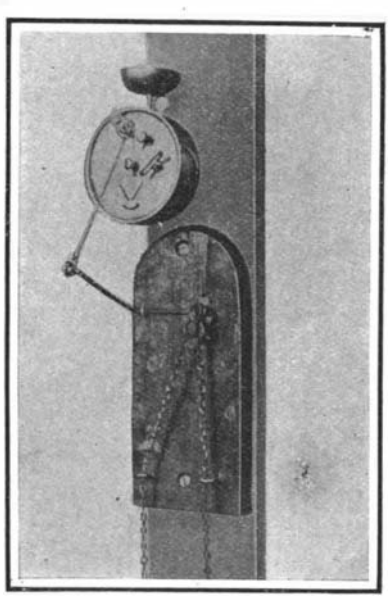
Fig. 2 represents two scales graduated alike, on which are shown the logarithms of numbers from 1 to 25. These scales may be made of any convenient length provided the representations of the logarithms are correctly proportioned. They may be obtained from any table of logarithms; and the unit may be assumed as large or as small as we please. In these scales the *number* is marked against the graduation instead of its logarithm.

A very simple example will illustrate the way in which the scales may be used for more complex computations. Find the value of the fraction $\frac{3 \times 8}{4} = 6$. Move the upper scale into position No. 1, bringing one end opposite 3 on the lower scale; and the reading opposite 8 on the upper scale is 24 on the lower scale. This operation is performed by adding the length of log 8 to that of log 3; and the sum is log 24, the logarithm of the product. Now move the upper scale into position No. 2, so that the graduation 4 is opposite 24 on the lower scale; and the reading opposite the end of the upper scale is 6 on the lower scale. In the second operation log 4 is subtracted from log 24; and the difference is log 6, the logarithm of the quotient. The logarithms of 2, 3, 4, and 5 are respectively one-half of the logarithms of their squares 4, 9, 16, and 25; i. e., the square of a number is found by doubling its length on the scale; and conversely the square root of a number is one-half its length. The cube of a number is three times its length; and its cube root one-third; the fourth power is four times; and the fourth root one-fourth, etc. The scale may be extended indefinitely; and products, quotients, powers, and roots of any numbers may be measured upon it.

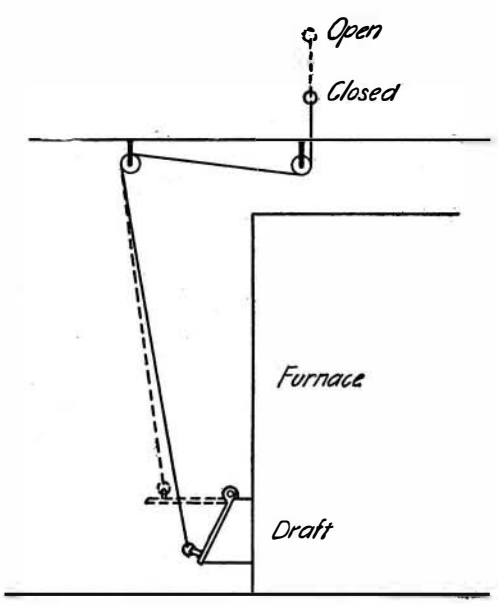
AN INTEREST AND DISCOUNT SLIDE RULE.

A useful application of the logarithmic measurements is found in a scale for the rapid determination of interest and discount. A portion of it is shown at Fig. 3. Let the numbers 470 to 530 on the lower scale represent these numbers of dollars. The lengths are proportioned to the logarithms of the corresponding numbers. The measurements are supposed to be made from a point beyond the limits of this page; but that part of it which is here shown, is determined without reference to this point. Its length is the difference between the logarithms of 530 and 470; and the positions of all the graduations on the scale are determined in the same manner. The scale may be made of any convenient length provided the proportions are correctly maintained; and the graduations may be carried out to any fraction of a dollar.

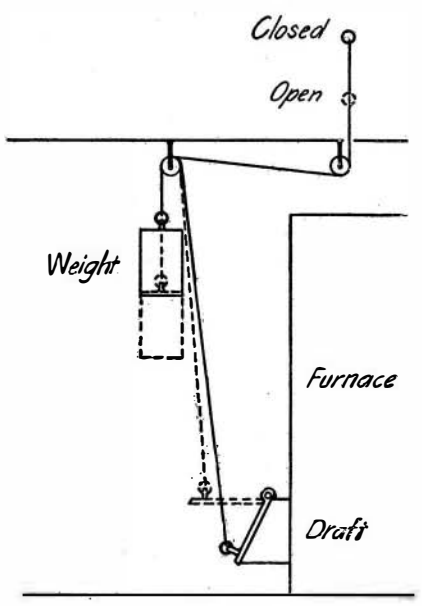
The upper or sliding scale is graduated for interest and discount. The lengths between the zero point—the logarithm of 1—and the points marked 4 per cent, 4½ per cent, and 5 per cent, represent the logarithms of 1.04, 1.045, and 1.05. This scale may be expanded indefinitely. For example: if the length for 7 per cent is required, the measurement is the logarithm of 1.07. While the scales may be made of any convenient length representing the logarithms of the numbers marked upon them, it should be noted that the same unit of measurement must be adopted in both scales. If it is required to find the amount, i. e., the sum of the principle and interest at a given rate per cent, the zero



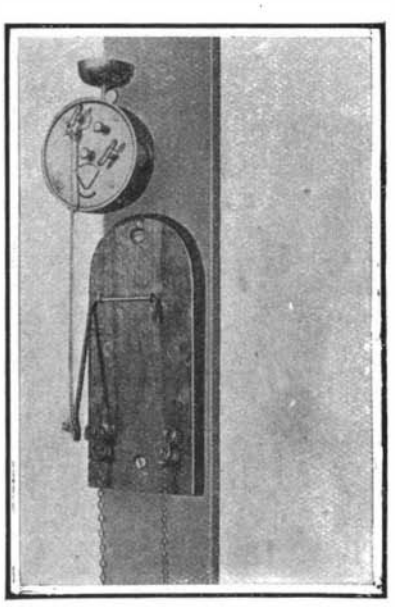
Drafts closed, alarm set.



Drafts directly connected to alarm key.



Arrangement with counterweight to open drafts.



Chains released, drafts open.

LET THE CLOCK OPEN THE FURNACE DRAFTS.